AIRS PULSE TUBE COOLER SYSTEM-LEVEL AND IN-SPACE PERFORMANCE COMPARISON

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JPL's Atmospheric Infrared Sounder (AIRS) instrument is designed to make precision measurements of atmospheric air temperature over the surface of the Earth as a function of height above the Earth's surface; the instrument uses a redundant pair of TRW pulse tube cryocoolers operating at 55 K to cool its sensitive IR focal plane. After having recently completed thermal vacuum testing at the spacecraft level, the instrument is scheduled for launch on NASA's Earth Observing System Aqua platform on March 24, 2002.

In support of spacecraft thermal vacuum testing and post launch checkout, new test and data reduction techniques have been developed to allow accurate intercomparison of instrument-level, spacecraft-level, and in-space performance of the coolers. The motivation for these techniques is the strong dependency of the performance of the cooler system on gravity. Specifically, the off-state conductance of the nonoperating redundant cooler is strongly dependent on convection, and thus gravity level and orientation. Because the instrument-level, spacecraft-level, and in-space environments have substantially different convection environments, test and analysis techniques had to be developed to allow accurate intercomparison of the results.

This paper presents the derivation of the test and analysis techniques as well as the measured system-level performance of the flight AIRS coolers during instrument-level, spacecraft-level, and in-space operation.

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